RMA TELEVISION TRANSMISSION

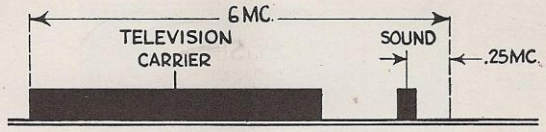

Fig. 1. A typical television channel.

FREQUENCIES AND STANDARDS

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JUST ABOUT a year ago the author had the pleasure of reporting the progress made by the RMA Television Committee (which reports to Dr. W. R. G. Baker, Director of Engineering) in formulating standards. Let us review these standards, Table I, to see what changes have taken place during 1937.

REVIEW OF STANDARDS

Skipping for a moment item 1, Frequency Allocation, we come to item 2, Channel Width: 6 mc. Fortunately the FCC has accepted this recommended standard, and all television channels recently assigned are 6-mc wide.

Item 3, Spacing between Television and Sound Carriers: 3.25 mc approximately—no change.

Item 4, Relation of Sound Carrier to Television Carrier: sound carrier higher in frequency. This standard remains unchanged.

Item 5, Polarity of Transmission: negative. Until a month ago the majority of the television transmitters were using negative modulation. Some are now using positive modulation and there is a possibility of this standard being changed.

Item 6, Number of Lines: 441. It is rather gratifying to find that this seemingly magic number of 441 lines, selected by the RMA Committee, has been echoed in the latest standards adopted in Germany and France.

Item 7, Frame Frequency: 30 per second. This remains unchanged. Field Frequency: 60 per second, interlaced. Unchanged. The choice of interlaced scanning has been endorsed after a comparative test by the British Broadcasting Corporation and more recently by the German Postoffice.

Item 8, Aspect Ratio: 4:3. Unchanged.

Item 9, Percentage of Television Signal Devoted to Synchronizing Signals: not less than 20 percent. Unchanged.

Item 10, Synchronizing Signal, (a) duration of horizontal and vertical blanking signals: approximately 1/10th of the time to scan one line, 1/10th of the time to scan one field, respectively. Unchanged. (b) Position of synchronizing pulses in regard to blanking signal: at the leading edge, approximately. Unchanged.

To this list of standards the Television Committee has added during the year:

Item 11, Position in the Channel of Sound Carrier:

.25 mc from the upper channel boundary.

Reason: To provide a guard band between the sound carrier and the adjacent service.

This is shown in Fig. 1.

This layout of a typical television channel, of course, presupposes double-sideband transmission. Future development may permit the lower sideband to be suppressed. When this is achived the spacing between the television and sound carriers will then be increased to more than the specified 3.25 mc.

COMPARISON OF FOREIGN AND AMERICAN STANDARDS

With our brief review of the American standards completed, let us compare them with the standards in use in England, France and Germany.

Let us return to Table 1. For item 5, Polarity of Transmission, we find the English, French and Germans are using positive transmission instead of negative.

For item 6 we have already mentioned that the French and Germans

TABLE I—RECOMMENDED STANDARDS OF RMA COMMITTEE ON TELEVISION

ITEM NO.		RMA RECOMMENDED STANDARD
1.	**Frequency Allocation**	
	Lower limit	42 mc
	Upper limit	90 mc
	An Experimental Band Starting	120 mc
2.	**Channel Width**	6 mc
3.	**Spacing Between Television and Sound Carriers**	3.25 mc
4.	**Relation of Sound Carrier to Television Carrier**	Sound carrier higher in frequency
5.	**Polarity of Transmission**	Negative
6.	**Number of Lines**	441
7.	**Frame Frequency**	30 per second
	Field Frequency	60 per second
8.	**Aspect Ratio**	4:3
9.	**Percentage of Television Signal Devoted to Synchronizing Signals**	Not less than 20%
10.	**Synchronizing Signal**	
	(a) Duration of Horizontal and Vertical Blanking Signals	Approximately 1/10th of the time to scan one line, 1/10th of the time to scan one field respectively
	(b) Position of Synchronizing Impulse in Regard to Blanking Signal	At leading edge (Approximately)

have adopted our 441-line standard. The English are using 405 lines.

Item 7—The frame frequency in England and on the Continent is 25, and the field frequency 50 per second, because the frequency of the supply mains is 50 cycles per second.

Item 9—We believe the British are using 30 percent instead of a minimum of 20 percent for synchronizing.

Item 10—Instead of the blanking signals occupying 1/10th of the time to scan one line, i.e., 10%, in Great Britain they occupy 15% of this time. No change otherwise in item 10.

Other important transmission characteristics not listed in this table will be mentioned later. So much for standards of today.

TABLE II—TELEVISION SYSTEM CHARACTERISTICS AS PROPOSED BY COMMITTEE MEMBERS

COMPANY	TRANSMISSION CHARACTERISTIC (PICTURE BACKGROUND)	POLARITY OF TRANSMISSION	HOR.-VERT. SYNCHRONIZING IMPULSES	QUALIFYING COMMENTS
CBS	d-c	positive	?	if avc available
Farnsworth	d-c or no standard	neg. pref. or positive 2nd choice	unequal	prefer "narrow vertical" synchronizing
GE	d-c	positive	?	if avc available
Hazeltine	d-c	positive	equal	
Philco	d-c	negative or positive	unequal	prefer "narrow vertical" synchronizing
RCA	d-c	positive	equal	if avc available

THE TREND OF STANDARDIZATION

Now for a look into the future. What will be the trend during 1938? You can draw some conclusions regarding this if I give you some extracts from memory taken at random from the minutes of the RMA Subcommittee on Television Standards, at the meeting in Philadelphia, September 20, 1937. These are some of the topics discussed.

Television transmission can be either horizontally or vertically polarized. The RCA organization submitted data which they have accumulated indicating that less noise was picked up on horizontal receiving antennas, and also there was less signal variation due to indirect path propagation. The committee agreed that standardization on this point was not required for the present.

Philco presented a statement regarding the merits of amplitude selection compared with waveform selection, and advocated the use of the former in connection with the narrow vertical synchronizing signals. It was the opinion of the Committee that standardization on this point be delayed.

Philco reviewed the desirability of attenuating one of the picture sidebands at the transmitter, and mentioned the work underway at W3XE in Philadelphia to accomplish this. The Committee was of the opinion that when this becomes practical the lower sideband is the one that should be attenuated.

RCA presented reasons indicating the desirability of automatic volume control in television receivers. The avc becomes more difficult when a d-c system with positive transmission is used. Some members felt that avc should be a fundamental portion of a television system.

Engineers from CBS, RCA, Hazeltine and Farnsworth had recently returned from Europe, and had many interesting facts to report on the status of television there. The Hazeltine company recommended standards having the principal features of the system used in England. Some of these standards are in accordance with American standards, others are not. These British standards were discussed, and the advantages of some of them were pointed out. Three principal system characteristics were considered; viz. (1) transmission characteristic or method of transmitting the picture background component, (2) polarity of transmission, and (3) type of vertical synchronizing signals. Tentative recommendations of the various companies concerning these factors are listed in Table II.

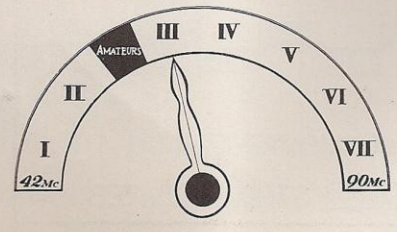
A glance indicates that all of the interests represented on the committee favor the d-c method of transmitting picture background. The majority favor positive transmission.

The heading of the third column of Table II may not be clear. It really means this: Should the horizontal and vertical impulses be equal or unequal in amplitude? Naturally, if they are equal in amplitude, wave-shape selection will be required to separate them at the receiver. On the other hand, if the pulses to be transmitted are of unequal height, then the vertical pulses being the higher can be selected at the receiver by amplitude selection. Another way to interpret this would be to ask the question: Do you prefer the serrated type or the narrow vertical type of synchronizing signal? Two companies preferred the latter; they were Farnsworth and Philco. Those companies expressing a preference for the serrated type of vertical synchronizing signal were Hazeltine and RCA. The question marks following CBS and GE indicate that they have not decided, further tests being necessary.

As to the qualifying comments, we have already mentioned the fact that avc with positive modulation is difficult to accomplish, therefore the following companies, CBS, GE, and RCA indicate that they favor positive modulation only if avc is available, that is, if it is found workable.

What choice has been made abroad regarding the characteristics in this table? In Germany they are using d-c background transmission, the polarity of transmission is positive, and the horizontal and vertical synchronizing impulses are of equal amplitude. The same is true in England.

Fig. 2. Television receiver dial.



FREQUENCY ASSIGNMENTS

Leaving now the question of television standards, let us find out what progress has been made during the year in solving a very important problem, vitally important to the future of the radio industry, at least that portion that anticipates the manufacture of television receivers. It is the problem of frequency allocation for television.

Refer for a moment to Fig. 2. This figure indicates that last year we had hopes of securing assignments in a continuous band from 42-90 mc. We also wanted an experimental band starting at 120 mc and going upward. This figure illustrates the desirability of having as nearly a continuous band as possible, because this simplifies the tuning of television receivers. What we wanted in frequency assignments is shown in Fig. 3. What we got is illustrated in Fig. 4.

Since the official announcement of the assignment of these bands by the FCC, October 16th, 1937, they have

been the subject of study. We have secured (as requested) for television 7 channels in the lower frequency block. Also there are 12 channels in the higher frequency block, but there are serious breaks in both bands. It must be remembered that the usefulness of frequency assignments above 90 mc for urban television broadcasting today is very doubtful indeed.

At any rate these are the channels that we experimenters are going to use in developing this new art in the United States. They already appear inadequate as to number, if one considers the channels that we are sure are satisfactory. However, it is up to us to make the best of the situation. We should overlook the difficulties and point out the advantages. The main advantages are that the assignment is reassuringly definite, definite as to channel width and channel location. These assignments are more permanent than any previous ones we have had.

Some may ask: How was this frequency assignment arrived at? The steps were these: On June 16, 1936, the RMA presented before a hearing of the FCC in Washington the television needs of the industry. At this hearing the requirements of the Army and Navy and other Government services were presented. These covered a great deal of the territory between 30 and 300 mc. Naturally these requirements conflicted with television needs.

About eight months later a meeting was arranged by Lt. Comdr. Craven (then Chief Engineer of the FCC), attended by a group of representatives of the RMA Television Committee and the Army and Navy and other Government representatives who form the group known as IRAC, that is the Interdepartmental Radio Advisory Committee of the Government. The RMA Committee presented and discussed television frequency needs. The Army and Navy representatives stated that they needed large bands of ultra-high frequencies for national defense, even in times of peace.

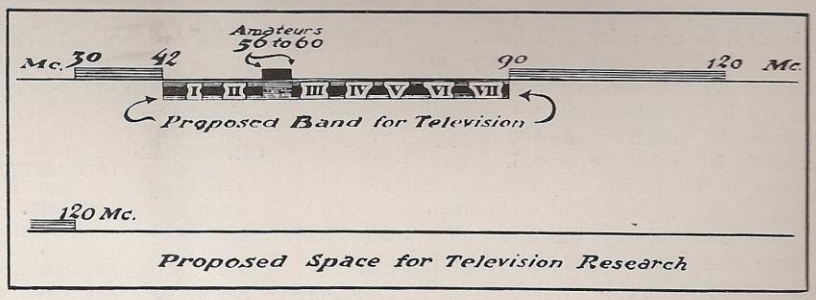


Fig. 3. The proposed television bands.

At a later IRAC meeting, at which we had Lt. Comd. Craven's help and support, the Army and Navy and Government services decided what channels they would give up to television. When these channels were submitted recently to the RMA Television Committee we voted to accept the new assignments for a trial period of one year. These new assignments, to be in force Oct. 13, 1938, are those given in Fig. 4.

In conclusion, official television frequency assignments have been made, so for some time to come this problem is closed.

As for television standards, those formulated by the RMA group, more than a year ago, have been of great value to the companies carrying on television research in the U. S. A., for instance, in crystallizing ideas, in promoting cooperation, and in guiding development work toward commercial television. These early standards have stood the test of time remarkably well. They have always been designated as tentative. They were set up to be changed. Now perhaps the time is approaching, when in view of experience at home and abroad, they should be changed.

The next step, then, for the RMA Television Committee is to consider carefully modification of the present standards and the addition of new standards.

In view of the technical improvements and developments in process in our various laboratories today we can thank our stars that we, in America, have not yet been completely bound by permanently fixed standards. We should be thankful that we are practical enough and not too proud to profit, where we can, by the commercial field experience of our British and German contemporaries, and by new developments in our own United States of America—the country that must lead the world in technical television development.

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ROCHESTER FALL MEETING

(*Continued from page* 12)

cular cross section. An idealized focusing field was assumed in that the initial perpendicular or radial component of electron velocity is assumed to be proportional to the distance of the electrons from the beam axis. The electrostatic force of the electron space charge is the only force considered to oppose the formation of a line or point focus on the beam axis at some distance from the focusing field. The electron density over any cross section of the electron beam is considered to be constant. The axial velocity of beam is assumed to be homogeneous. For the rectangular beam two cases were considered: (1) the electron beam in a field-free space, (2) the electron beam accelerated by a uniform axial potential gradient. The circular beam is assumed to be in a field-free space. The relations between the variables beam current density, voltage, initial angle and the distance between focusing field and the focal point were shown by curves. In cathode-ray tubes made at present for television and oscillographic purposes the space-charge limitation on the focus is not of great importance because other factors contribute largely to the spot size. How-

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Fig. 4. The recent television frequency assignments.